

REMARKS

In order to further distinguish the claimed invention over the cited prior art, Claim 1 has been amended to state that the polymerizable polysaccharide derivative has 5 to 35% of polymerizable unsaturated groups based on the hydroxyl groups of the polysaccharide and that the polymerizable monomer having polymerizable unsaturated groups is selected from the group consisting of styrene and dimethylbutadiene. Support for these amendments can be found on pages 8 and 11 of the present specification respectively. Accordingly, Claim 15 has been canceled and Claims 13 and 14 amended. No new matter has been added.

Claims 1-3, 9, 10, 12, 13, 15 and 16 have been rejected under 35 USC 102(b) as being anticipated by or, in the alternative, under 35 USC 103(a) as being obvious over either Kimata or JP '141. Claim 3 has been rejected under 35 USC 103(a) as being unpatentable over either Kimata or JP '141 in view of Murakami. Claims 11 and 14 have been rejected under 35 USC 103(a) as being unpatentable over either Kimata or JP '141 in view of Oda. Applicants respectfully traverse these grounds of rejection and urge that the currently presented claims are clearly patentably distinguishable over the prior art cited by the Examiner.

The presently claimed invention is directed to a separating agent for enantiomeric isomers which comprises a polymerizable polysaccharide derivative having 5 to 35% of polymerizable unsaturated groups based on the hydroxyl groups of the polysaccharide, a polymerizable monomer having polymerizable unsaturated groups selected from the group consisting of styrene and dimethylbutadiene and a carrier having polymerizable functional groups. The polymerizable polysaccharide derivative, the polymerizable monomer and the carrier are copolymerized with one another to be chemically bond mutually such that the immobilization rate of the polysaccharide derivative is at least 80%.

As pointed out previously, the instant invention is based on the discovery that when a separating agent is formed from a polysaccharide derivative having 5 to 35% polymerizable unsaturated groups, a polymerizable monomer having polymerizable unsaturated groups selected from the group consisting of styrene and dimethylbutadiene and a carrier having polymerizable functional groups, and the polymerizable polysaccharide derivative, polymerizable monomer and carrier are copolymerized with one another to be chemically bound mutually so that the immobilization rate of the polysaccharide derivative is at least 80%, the carrier has an unexpectedly improved high separating ability and high solvent resistance.

The amount of the polymerizable unsaturated groups of the polymerizable polysaccharide derivative is limited to 5 to 35% which is unexpectedly small. Additionally, copolymerizable of the polymerizable monomer with the polysaccharide derivative at the polymerizable unsaturated groups increases the immobilization rate of the polysaccharide derivative which compensates for a decreased immobilization rate caused by the low amount of polymerizable unsaturated groups of the polymerizable polysaccharide derivative. The polymerizable monomer is limited to styrene or dimethylbutadiene and provides the separating agent with unexpectedly superior separating properties. The hydroxyl group of the polysaccharide derivative is not polymerized with a polymerizable monomer having polymerizable unsaturated groups and is not limited to styrene or dimethylbutadiene. In the present invention, the hydroxyl groups other than those copolymerized with the polymerizable monomer are substituted with a non-polymerizable monomer. This allows almost all of the hydroxyl groups of the polysaccharide derivative to be substituted with either the polymerizable groups of the claimed invention or a non-polymerizable compound. In the production of 6-CVDMPC and 6-CMDMPC of the present invention, it is noted that the cellulose is treated to have a non-polymerizable group at the 2- and 3-positions and a polymerizable group at the 6-position.

Due to the high immobilization rate of the polysaccharide derivative, the carrier has both a high separating ability and high solvent resistance. The high immobilization rate achieved by the present invention results in superior separating abilities due to the high content of optical separation groups contained in the inventive separating agent. It is respectfully submitted that the prior art cited by the Examiner does not disclose the presently claimed invention.

The Kimata et al reference discloses an optical separating agent which is formed through the polymerization of a polysaccharide derivative having vinyl groups introduced into the hydroxyl groups thereof through an ester or urethane linkage on the surface of a porous support or by copolymerizing the polysaccharide derivative having vinyl groups introduced therein with a porous support having vinyl groups introduced therein. This reference states that the hydroxyl groups of the polysaccharide are substituted in such an amount as to be soluble in a good solvent for the polysaccharide derivative. It is well known to one of ordinary skill in the art that the lower the substitution rate the polysaccharide derivative has, the more insoluble it is. As a result, one of ordinary skill in the art would be lead to think that in order to obtain a polysaccharide derivative that is soluble in a good solvent, it would need more than 35% of a polymerizable group. In Kimata, it is preferable to substitute a large percent, up to 100% of the hydroxyl groups of the polysaccharide derivative of the compound having a polymerizable group. However, chemical substitution in such a large amount would damage the separating agent's separation ability. If the polysaccharide derivative of Kimata et al contained only from 5 to 35% of polymerizable unsaturated groups, it would be insoluble in a good solvent for the polysaccharide derivative, such as methylene chloride, which goes against the object of this reference.

Additionally, Kimata et al has no disclosure with respect to utilizing a polymerizable monomer during the copolymerization of the polysaccharide derivative having

polymerizable functional groups with a carrier having polymerizable functional groups. Kimata et al has no disclosure why it would be desirable to have a polymerizable monomer having polymerizable unsaturated groups participate in a copolymerization reaction between the polysaccharide derivative having polymerizable functional groups and a carrier having polymerizable functional groups. As such, it is respectfully submitted that Kimata et al not only does not anticipate the presently claimed invention under 35 USC 102(b), it does not even present a showing of prima facie obviousness under 35 USC 103(a). The comparison of the present invention and Kimata et al is shown in the enclosed sketch. As such, the presently claimed invention clearly is patentably distinguishable thereover.

JP '141 discloses an optical separating agent which is made up of a polysaccharide derivative having a vinyl group introduced at the hydroxyl group site through an ester or urethane linkage which is copolymerized with a vinyl group provided on a porous carrier. This reference has an identical disclosure to that of Kimata et al in that it has no suggestion of conducting the copolymerization reaction between the polysaccharide derivative having a vinyl group and the porous carrier having a vinyl group in the presence of a polymerizable monomer which participates in the copolymerization reaction. Additionally, like the previously discussed reference, this reference does not suggest why it would be advantageous to have a polymerizable monomer present during the copolymerization reaction between the polysaccharide derivative having the vinyl group and the carrier having the vinyl group. Therefore, like the previously discussed reference, this reference does not even present a showing of prima facie obviousness under 35 USC 103(a) with respect to the presently claimed invention.

Murakami et al discloses a separating agent which is prepared by immobilizing a polysaccharide derivative on a support by cross-linking the polysaccharide derivative molecules exclusively among themselves on the support.

Murakami has been cited by the Examiner as disclosing that the 6-position is a desirable location to link polysaccharides. However, like the previously discussed references, this reference has no disclosure with respect to adding a polymerizable monomer to a copolymerization reaction between a polysaccharide derivative having polymerizable unsaturated groups and a carrier having polymerizable functional groups to obtain a product in which the polymerizable polysaccharide derivative, polymerizable monomer and carrier all copolymerize with each other to be chemically bound mutually such that the immobilization rate of the polysaccharide derivative is at least 80%. Therefore, this reference adds nothing to the previously discussed references.

The Oda et al reference discloses a packing material comprising a carrier coated with a substance having a separating capacity for high-performance liquid chromatography. This reference has been cited by the Examiner as disclosing that cellulose phenylcarbamate is commercialized and widely used because of its high optical resolving powers. However, like all of the previously cited references, Oda et al has no disclosure with respect to adding a polymerizable monomer to a polymerization reaction between a polysaccharide derivative having polymerizable unsaturated groups and a carrier having polymerizable functional groups in order to obtain a separating agent in which the immobilization rate of the polysaccharide derivative is at least 80%. As such, the references cited by the Examiner, either singularly or in any combination, do not even present a showing of prima facie obviousness under 35 USC 103(a) of the presently claimed invention.

In the Final Rejection, the Examiner states that the presently claimed process steps and the process steps of both Kimata and JP '141 are the same and, as such, the immobilization rate would appear to be the same. However, as discussed above, the process steps are not the same in that the present invention requires that the copolymerization reaction be conducted in the presence of a polymerizable

monomer which also participates in the copolymerization reaction. In contrast thereto, neither Kimata nor JP '141 disclose a polymerizable monomer taking part in the copolymerization reaction disclosed there. The Examiner states that the last sentence of the second paragraph on page 7 of the translation of JP '141 discloses the use of monomers. However, this reference discloses the use of a cross-linking agent such as divinylbenzene, ethylenediamine dimethacrylate, ethylene glycol diacrylate, etc. and second and subsequent polymerization reactions. The cross-linking agents are not monomers in that they do not form polymers and do not participate in the copolymerization reaction as required by the present claims. As such, Applicants disagree with the Examiner's position that JP '141 discloses the use of monomers.

The Examiner has also stated that Kimata discloses, on column 5, lines 43-53, the use of monomers. As with the previously discussed reference, the vinyl group-containing compounds disclosed in column 5, lines 43-53, of Kimata are cross-linking agents and not monomers and do not participate in the copolymerization reaction as required by the present claims. As such, Applicants respectfully submit that the Kimata reference also does not disclose the use of monomers participating in a copolymerization reaction between the polysaccharide derivative having polymerizable unsaturated groups and the carrier having polymerizable functional groups as required by the present claims.

Although the Examiner has not made a showing of prima facie obviousness under 35 USC 103(a) of the presently claimed invention, objective evidence is of record in the present application which is more than sufficient to establish the patentability of the presently claimed invention. The Examiner states in the outstanding Office Action that a comparison has not been made with the closest prior art. Applicants respectfully disagree with this statement. Comparative Example 2 in the present specification corresponds with the disclosures of Kimata and JP '141 in that the

polysaccharide derivative containing a vinyl group was reacted with a porous carrier containing a vinyl group in the absence of a polymerizable monomer. This Example falls clearly within the disclosure of the primary references cited by the Examiner. None of the references cited by the Examiner in the Final Rejection had an immobilization rate as high as 80%, which is required by the present claims. As can be seen by comparison with Examples 1, 3 and 4, Comparative Example 2 only had an immobilization rate of 70% as compared to an immobilization rate of at least 90% with the present invention and as shown in Tables 1 and 2 of the present application, the separating agent of the present invention has superior separating properties as compared with those of Comparative Example 2. This is clearly unexpected in light of the disclosure of the references cited by the Examiner and establishes the criticality of the polymerizable monomer being present during the copolymerization reaction.

The Examiner is respectfully requested to reconsider the present application and to pass it to issue.

Respectfully submitted,


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Encl: Sketch showing comparison between Kimata et al
and the present invention

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